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ABSTRACT

Designed to improve students' thinking, learning, and creative skills while they learn to program a microcomputer in BASIC programing language, this book for intermediate learners at the junior high level provides a variety of microcomputer activities designed to extend the concepts learned in the accompanying instructional manuals (Volumes 3 and 4). These activities require students to apply those concepts to challenging problems which need original and creative solutions. Each activity includes a program to enter, run, and observe, and a challenge requiring use of a principle taught in the related instructional manuals. Changes to clarify the use of a new principle are included for some projects. Activities include: creating programs that ask for the first name of a person to be guessed; print on the screen only those numbers that can be divided evenly by 7; store random numbers; store 5 random integers in an array; print all the whole numbers from 1 to 10 and print a star next to those numbers that are even multiples of 3; print the message EVEN or ODD after each number from 1 to 10; and display a small spaceship on the screen. A final superchallenge asks students to create and save several subprograms that can be combined to form the start of a game. (Author/LMM)

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THINKING · LEARNING · CREATING

TLC

MICROCOMPUTER PROJECTS

for Growing Minds

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Junior High Projects for Volume 3&4

THINKING · LEARNING · CREATING

TLC

MICROCOMPUTER PROJECTS

for Growing Minds

Junior High Projects for Volume 3&4

by Henry A. Taitt

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CREATIVE LEARNING ASSOCIATION, INC.
RR#4, Box 330
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ENTER/RUN/OBSERVE

RUN this program:

```
10 PRINT "GUESS A COLOR!"
15 INPUT A$
20 IF A$="RED" THEN GOTO 40
30 GOTO 10
40 PRINT "RED IS RIGHT!"
```

Add this for an ATARI.

```
 5 DIM A$(20)
```

Make this change for a TI.

```
20 IF A$="RED" THEN 40
```

CHALLENGE

Create a program that asks for the first name of a person to be guessed. You pick the person you want to be the accepted guess.

ENTER/RUN/OBSERVE

```
10 FOR X=0 TO 5 STEP .5
20 PRINT X, INT(X)
30 NEXT X
```

Notice how the INT(X) command works.

CHANGE IT/RUN/OBSERVE

Try this change.

```
10 FOR X=-3 TO 3 STEP .3
```

CHANGE IT/RUN/OBSERVE

Try this program.

```
10 FOR X=-8 TO 8 STEP .3
20 PRINT X, INT(X)
30 PRINT (X/3), INT(X/3)
40 NEXT X
```

CHALLENGE

Create a program that will print on the screen only those numbers that can be divided by 7 evenly. Consider all whole numbers from 1 to 100.

CHALLENGE

Create a program that will store 1Ø random numbers. Each number must be an integer between 1 and 9.

Have your program display the odd integers on the left and the even numbers on the right.

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ENTER/RUN/OBSERVE

Try this program.

```
10 FOR X=0 TO 10
20 PRINT X
30 IF X=5 THEN PRINT, "FIVE"
40 NEXT X
```

On the TI, make these changes.

```
30 IF X=5 THEN 100
100 PRINT, "FIVE"
```

CHANGE IT/RUN/OBSERVE

Change this line, and RUN it again.

```
30 IF X> 5 THEN PRINT, "LESS THAN FIVE"
```

CHALLENGE

Create a program that will display for each number printed one of the messages below.

LESS THAN FIVE
FIVE
MORE THAN FIVE

ENTER/RUN/OBSERVE

Enter and RUN this program.

```
10 FOR C=1 TO 255
20 PRINT CHR$(C)
30 NEXT C
```

Notice that some of the values for C produce actions rather than characters displayed on the screen.

CHANGE IT/RUN/OBSERVE

Using editing commands, make this change in line 20.

```
20 PRINT C, CHR$(C)
```

CHANGE IT/RUN/OBSERVE

Now make this change.

```
20 PRINT "(";C;")  ";CHR$(C);"   ";
```

CHALLENGE

Alter and edit the above program to produce a display that will fit on your display screen that includes only those values of C that display symbols on the screen. Use IF-THEN commands to eliminate those you do not want. If you have a printer connected to your computer, also get a hardcopy of the display.

CHALLENGE

Create a program that will store five random integers in an array. Then create a second array where your program stores them in order of smallest to largest.

Have both arrays displayed on the screen. Have each labeled.

ENTER/RUN/OBSERVE

Enter and RUN: *(If your computer won't accept line 1Ø, put the message in a PRINT statement and use a separate line number for the INPUT.)*

```
10 INPUT "ENTER SOME NUMBER OF DOLLARS";N
20 Z=N/3
50 PRINT "$";N;" DIVIDED BY THREE IS $";Z
55 FOR T=1 TO 2000
60 NEXT T
70 GOTO 10
```

Notice what happens if you input ten dollars?

Now add these lines:

```
30 X=INT(100*Z)
40 Z=X/100
```

Input ten dollars again. Notice what happened to the last threes!

CHALLENGE

When you RUN the above program it is not always correct to the nearest penny. (For instance, when you INPUT 20 dollars.) Can you change it so that it will be correct to the nearest cent?

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CHALLENGE

This program has mistakes as well as commands that your computer does not understand. Edit out the mistakes and make whatever changes are necessary in the commands to get the program to RUN.

```
10 HOME
20 PRINT "THIS PROGRAM WILL DRAW A LETTER."
30 REM ** THE LETTER IS X **
40 FOR X=10 TO 30
50 SET (X,X):SET(40-X,X)
55 NEXT X
60 COLOR=15
70 HLIN 10, 30 AT 42
80 GOTO 80
```

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CHALLENGE

Create a program that will print all the whole numbers from 1 to 1Ø, and print a star (*) next to those numbers that are even multiples of 3.

Have a (!) next to those that are even multiples of 4.

Have a (+) next to those that are even multiples of 2.

ENTER/RUN/OBSERVE

Enter and RUN this program:

```
20 FOR D=1 TO 6
30 X=RND(1)
40 PRINT X, 10*X, INT(10*X)
50 NEXT D
```

Some computers use RND instead of RND(1).

CHANGE IT/RUN/OBSERVE

If line 40 does not cause three columns to be displayed on your screen, change it so it will.

CHANGE IT/RUN/OBSERVE

Make these changes and RUN it.

```
38 Y=-X
40 PRINT X, 10*X, INT(10*X), INT(10*Y)
```

If line 40 does not cause four columns to be displayed on your screen, change it so it will.

CHANGE IT/RUN/OBSERVE

Now one more change!

```
**********************************************
*                                            *
* 3Ø X=INT(1Ø*RND(1))                        *
*                                            *
**********************************************
```

CHALLENGE

Figure out what the INT(X) command does to negative and positive numbers. Would there be a difference in the above results if line 4Ø looked like this?

```
**********************************************
*                                            *
* 4Ø PRINT X, 1Ø*X, 1Ø*INT(X), 1Ø*INT(Y)     *
*                                            *
**********************************************
```

(Have line 4Ø produce four columns.)

CHALLENGE

a) Create a program that will print the message EVEN or ODD after each number from 1 to 1Ø. Start your program with line number 3ØØ. Do not erase it when you start part (b).

b) Using line numbers less than 3ØØ, create a program to randomly pick a number between 1 and 1Ø. Change the number to an integer and then, combining it with part (a), decide if it is EVEN or ODD.

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ENTER/RUN/OBSERVE

```
10 FOR T=1 TO 5
20 A(T)=RND(1)
30 NEXT T
```

For an ATARI, add
5 DIM A(5)
For a TI, add
15 RANDOMIZE
and change RND(1) to RND

There are now five random numbers stored in an array.

```
40 FOR N=5 TO 1 STEP -1
50 PRINT N, A(N)
60 NEXT N
```

This will print them with the last one first.

CHALLENGE

Create a program that will take the five random numbers above and display only the largest one.

CHALLENGE

Change the above program to print only the smallest one.

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INFORMATION

You start with $100 in cash. Each time it is your turn, you lose half the cash you have left.

CHALLENGE

Create a computer program that will display the number of your turn and the money you have left. Have the program stop when you have less than one dollar.

BONUS

Change the amount to $1000. Now how many turns will it take to run out of money?

Change the amount to $2000. How many turns now?

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ENTER/RUN/OBSERVE

For an ATARI, add:
5 DIM A(10)

Enter this program:

```
10 FOR T=1 TO 10
20 A(T)=INT(10*RND(1))
30 NEXT T
```

If you have trouble, try RND instead of RND(1).

You have now stored 10 random numbers in an array. Add these lines:

```
40 FOR X=1 TO 10
50 PRINT A(X)
60 NEXT X
```

This will print them in a column.

CHALLENGE

Create a program that will find their sum.

CHALLENGE

Create a program that will find their product.

CHALLENGE

You have a six-sided die with numbers from one to six. Create a program that will display the random results of rolling such a die ten times. Did 6 appear? Did zero?

CHALLENGE

Now you have two such die. Create a program that will produce a table like the one shown below, for 10 rolls of the dice.

DIE #1	DIE #2	TOTAL SHOWN
3	1	4
3	5	8
4	5	9
1	4	5

-etc.-

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ENTER/RUN/OBSERVE

Enter the command your computer uses (if it has one) to display the amount of memory that is free for your use.

```
PRINT FRE(Ø)          Select one of these
PRINT MEM
```

Record the number shown.

Now enter each of the following lines. Determine the amount of free memory after each line.

```
     PRINT "HOW MUCH MEMORY DID THIS TAKE?"
1Ø   PRINT "HOW MUCH MEMORY DID THIS TAKE?"
1Ø PRINT "12345"
1Ø PRINT 12345
1Ø A$="HELLO":PRINT A$
1Ø A$="HELLO":PRINT "HELLO"
```

CHALLENGE

Create a ten-line program that will RUN. Then explore and see how you can accomplish the same results while using less memory.

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ENTER/RUN/OBSERVE

Enter this program and RUN it.

```
10 X=X+1
20 PRINT X
30 IF X=10 THEN 50
40 GOTO 10
50 END
```

Some computers will accept this. If yours will not, change line 30 so it will work.

CHANGE IT/RUN/OBSERVE

Try these changes. See which will work.

```
30 IF X=10 END
```

Now this one.

```
30 IF X=10 THEN END
```

And now this.

```
30 IF X=10 THEN GOTO 50
```

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CHANGE IT/RUN/OBSERVE

Type NEW, then enter the program below.

Make it work on your computer.

```
10 X=X+1
30 IF X=1000 THEN END
40 GOTO 10
```

Time your computer to see how long it takes to do this 1000 times.

CHANGE IT/RUN/OBSERVE

Now add:

```
20 PRINT X
```

Time it again and see if it is slower.

CHANGE IT/RUN/OBSERVE

Change these three lines and time it again.

```
10 FOR X=1 TO 1000
30 NEXT X
40 END
```

Was IF-THEN or FOR-NEXT faster?

How much did line 20 slow it down?

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STOP!

You have finished all the YELLOW projects. Pat yourself on the back. That's quite an accomplishment!

NOW!

Before starting on the GREEN projects, you'll need to learn some new commands from Volume IV of TLC FOR GROWING MINDS. When you have finished that volume, come back and sharpen your skills with the GREEN projects.

ENTER/RUN/OBSERVE

```
 20 PRINT "THIS IS A ONE QUESTION QUIZ."
 30 PRINT
 40 PRINT "HOW OLD ARE YOU?"
 50 PRINT
 60 PRINT "      1.)  12 YEARS OLD"
 70 PRINT "      2.)  21 YEARS OLD"
 80 PRINT "      3.)  TOO OLD TO TELL!"
 90 PRINT "      4.)  NONE OF THE ABOVE "
100 PRINT
110 PRINT " ENTER THE NUMBER THAT BEST
ANSWERS THE QUESTION."
115 INPUT N
140 ON N GOSUB 1000,2000,3000,4000
1000 PRINT "WOW!  YOU'LL SOON BE A TEENAGER!"
1010 A=A+1
1020 GOTO 20
2000 PRINT " ENJOY IT!  YOU'LL NEVER BE THAT
AGE AGAIN!"
2010 B=B+1
2020 GOTO 20
3000 PRINT " TOO OLD...OR TWO PROUD?"
3010 PRINT " EITHER WAY, YOU LOOK GREAT!"
3020 C=C+1
3030 GOTO 20
4000 PRINT "WELCOME TO THE CROWD!"
4010 D=D+1
4020 GOTO 20
```

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CHANGE IT/RUN/OBSERVE

Add a line or two that will allow a delay so the messages in the subroutines can be read.

CHANGE IT/RUN/OBSERVE

Add a line or two that will print out the values of A, B, C, and D when the question has been answered ten times.

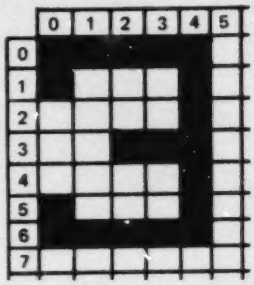
CHALLENGE

Create a humorous five-question quiz that can be taken by many people. Include in your program the ability to keep track of how many times each answer is selected.

After each person answers a question, display for that question how many people have picked each answer. This can be used to tally the responses.

INFORMATION

Before microcomputers were developed, light bulbs were used to display words and numbers at ball games and on electrical signs. If the light bulbs were placed in seven rows of five bulbs per row, it was found that all the numbers from zero to nine could clearly be displayed. Notice the number three shown below.



CHALLENGE

Starting with line number 3000, create a program that will display a large number 3 in the center of your screen.

Starting with line number 5000, create a program that will display a large number 5 in the same location.

Do this for the numbers from one to five.

When you have them all working, add GOTO 1Ø as the last line in each sub program and then enter this program.

```
1Ø FOR T=1 TO 1ØØØ
2Ø NEXT T
3Ø (Place clear screen command here)
4Ø PRINT "ENTER A NUMBER BETWEEN 1 AND
5."
5Ø INPUT N
6Ø (Place clear screen command here)
7Ø ON N GOTO 1ØØØ,2ØØØ,3ØØØ,4ØØØ,5ØØØ
```

SAVE this program. Name it COUNT.

CHALLENGE

Using the COUNT program, make the necessary changes so that it becomes a 5-second counter.

BONUS

Using the COUNT program, make the necessary changes so that you may INPUT a number from 1 to 1Ø and have the program count out that many seconds.

ENTER/RUN/OBSERVE

Start your program with the command that clears the video display. Then enter and RUN this program: *(Skip this if you have an ATARI.)*

```
10
20 FOR X=0 TO 39
30 PRINT TAB(X)"#";
40 NEXT X
```

Put the command to CLEAR SCREEN on line 10.

For a TI, place a semicolon after TAB(X).

CHALLENGE

Using PRINT TAB(X),

a) Create a program that will draw a diagonal line.

b) Try a vertical line down the middle of your video display.

c) Try drawing a large X.

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CHALLENGE

Create a subroutine program that will display a small spaceship on the screen. Create another one that will display an exploding spaceship.

Have your spaceship move across the screen and explode.

BONUS

If your computer understands INKEY$, design your program to explode when you press the E key.

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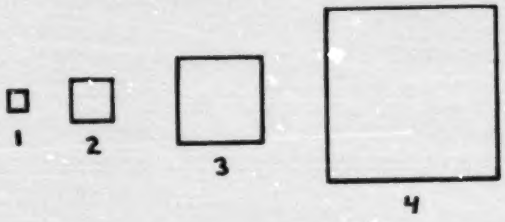
INFORMATION

Sometimes it is desirable to create the impression of something moving towards you. This can be done by drawing objects of increasing size, one on top of the other.

Create a program that will draw an object the size of #1 in the center of your screen. Then have your program clear the screen and draw #2 at the same spot. Then #3 and then #4.



Put a delay loop between each drawing. Select a delay time that will make the apparent growth seem smooth.

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ENTER/RUN/OBSERVE

(Try it first without line 5.)

```
  5 DIM A(26):REM** TO ALLOW A LARGER ARRAY **
 10 REM** FILL ARRAY WITH ASCII CODES **
 20 FOR X=65 TO 90
 30 N=N+1
 35 A(N)=X
 50 NEXT X
 60 REM** RANDOMLY SELECT CODES FOR WORDS **
 70 FOR L=1 TO 5
 80 W=INT(26*RND(1))
 90 PRINT CHR$(A(W));
100 NEXT L
110 REM** PRINT 120 WORDS **
115 PRINT "   ";
120 C=C+1
130 IF C=120 THEN END
135 GOTO 70
```

Make any changes necessary for this to RUN on your computer.

CHALLENGE

Can you figure out why all the words do not contain five letters? Change the program to produce four letter words. Increase the number of words that it produces.

If you have the use of a printer, get 1000 of these randomly produced words printed.

How many of the words produced can you find in a large dictionary?

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ENTER/RUN/OBSERVE

Make whatever changes are necessary to get your computer to RUN this program. (For an ATARI, see the next page.)

```
 5 DIM A$(25)
10 (Use the command to clear the screen.)
20 FOR T=1 TO 25
30 READ N$
35 A$(T)=N$
36 PRINT N$;
40 NEXT T
50 DATA T,H,I,S," ",I,S," ",D,A,T,A," ",T,
O," ",B,E," ",S,T,O,R,E,D
55 PRINT
60 FOR Y=25 TO 1 STEP -1
70 PRINT A$(Y);
80 NEXT Y
90 GOTO 90
```

When it runs successfully, it should create a display that looks like this:

```
THIS IS DATA TO BE STORED
DEROTS EB OT ATAD SI SIHT
```

Notice that the second line is the first line backwards. (See the next page for a different way to do this.)

ENTER/RUN/OBSERVE

Make whatever changes are necessary to get your computer to RUN this program.

```
 5 DIM A(25)
10  (Use clear screen command)
20 FOR T=1 TO 25
30 READ N
35 A(T)=N
36 PRINT CHR$(N);
40 NEXT T
50 DATA 84,72,73,83,32,73,83,32,68,65,84,65,
32,84,79,32,66,69,32,83,84,79,82,69,68
55 PRINT
60 FOR Y=25 TO 1 STEP -1
70 PRINT CHR$(A(Y))
80 NEXT Y
90 GOTO 90
```

When it runs successfully, it should create a display that looks like this:

```
THIS IS DATA TO BE STORED
DEROTS EB OT ATAD SI SIHT
```

Notice that the second line is the first line backwards.

(See next page)

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CHALLENGE

Make the necessary changes in the program to print the words in group A on one line and then print them backwards on the next line. Do the same for the words in group B. What do you notice about each group?

GROUP A	GROUP B
RAT	MOM
LIVE	DAD
DOG	MADAM
WAR	DEED
MAD	RADAR

Can you think of other words to add to group A or B?

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CHALLENGE

Create a simple computer game that allows the user to try and guess a random integer (greater than zero and less than 1ØØ) picked by the computer.

For each number that the user INPUTs as the answer, the program should display a message indicating whether the number is too low, too high, or correct.

The program should allow only seven guesses. If the user can guess the number in seven or less guesses, the user wins. If not, the computer wins. Have the program keep track of wins for both sides.

Save your program when you are pleased with the way it works. Call it HIGHLOW. Use subroutines.

CHALLENGE

The program you created called HIGHLOW had the user guess a number selected randomly by the computer.

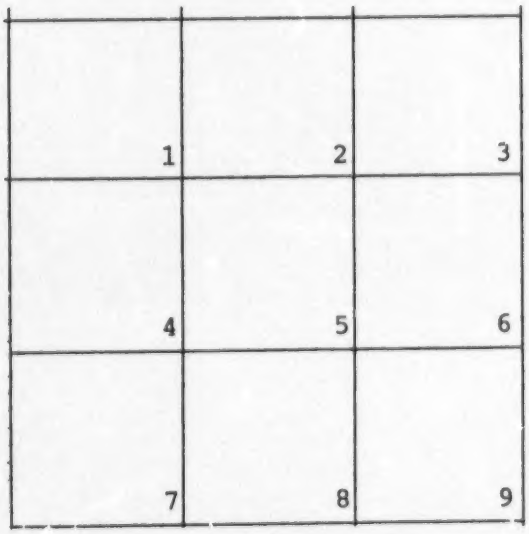
Starting with that program, add a second part that allows the user to select a number and have the computer guess the number.

Place a menu at the start of your program to allow either option to be selected or a combination that allows first the computer to select a number then the user to select a number.

Use subroutines.

SUPER CHALLENGE

In the next several projects, you will create and save several subprograms that can be put together to form the start of a game. Create each part as a subroutine that ends with RETURN. First, create a program that will draw the game board shown below. It should be about the size below. Use line numbers between 1000 and 1999.



Call this program HEXAPAWN and SAVE it.

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Next, create two subroutines that can be used as "markers." They should be different and should be small enough to fit inside the square below.

Use line numbers between 2000 and 2999 for one of them and line numbers between 3000 and 3999 for the other one.

The program should be created so that when the subroutine is selected, it will display the "marker" wherever the cursor is located at that moment.

In the game of HEXAPAWN, a marker may move one space forward if the space before it is unoccupied. If the space is occupied, that marker cannot move forward.

If an opponent is located at a square that is diagonally adjacent, you may remove the opponent's marker and move your marker to that spot.

For example, if O has the first move, the following moves are possible:

7 to 4

8 to 5

9 to 6

+ 1	+ 2	+ 3
4	5	6
O 7	O 8	O 9

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Suppose O moved 8 to 5. Now + has the following possible moves:

1 to 4
1 to 5
take O
3 to 6
3 to 5
take O

+ 1	+ 2	+ 3
4	O 5	6
O 7	8	O 9

Players take turns moving one of their pieces per move.

You win if you get one of your markers to your opponent's starting row, or if your opponent does not have a possible move.

Create a subroutine that provides the instructions and examples given above. Use line numbers starting with 4000.

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In order to create the game of HEXAPAWN, one must logically decide what steps are necessary. Once these steps are listed, subroutines can be created to accomplish each step. Then a command program can be created to use the subroutines as they are needed.

Suppose the list of steps looks like this:

1.) Opening display showing the name of the game, the author, and the copyright information.

2.) Asks for the names of the two people who will be playing and assigns them to a string variable.

*3.) Asks if you wish instructions and branches to instructions if requested.

*4.) Draws the game board and numbers the squares.

*5.) Creates a marker for player A. Will place it at a specified location.

*6.) Creates a marker for player B. Will place it at a specified location.

7.) Will specify locations for markers for the start of a game.

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8.) Decides whose move it is.

9.) Asks for move.

10.) Checks the legality of the move. If not legal, declares the game lost and goes to score keeping routine.

11.) Clears square to be occupied.

12.) Draws marker in correct square.

13.) Clears square just vacated.

14.) Checks for "backrow" win.

15.) Checks for "no-move" win.

16.) Records and displays win if won.

17.) Prepares for next move.

18.) Asks if you want another game.

19.) Anything else you think needs to be done.

At this point, you already have created those subroutines that are starred (#3, 4, 5, and 6).

If you would like, it would be an extremely valuable experience to create the remaining subroutines and the command program that would allow two people to play the game of HEXAPAWN on a computer.

If you decide to do this, make a chart of what each variable represents. It will help prevent confusion.

You are a very good GREEN LEVEL programmer to have gotten to this project. Do not try this project unless YOU want to do it!

If you succeed and get your program to RUN, send a copy on disk or tape, or even a print-out, to:

Henry A. Taitt
CREATIVE LEARNING ASSOCIATION
R.R. 4, Box 330
Charleston, IL 61920

Let me know your age, school, home address, and the computer you used. I would also like to see what you look like. Send along a snapshot of yourself.

CONGRATULATIONS!

You have completed the INTERMEDIATE SERIES OF TLC FOR GROWING MINDS:

INTERMEDIATE SERIES

TLC FOR GROWING MINDS VOLUME 3 (YELLOW)

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